CLAIMS

What is claimed is:

1. An acoustic logging tool that comprises:

an acoustic source configured to excite wave propagation in a quadrapole mode;

an array of acoustic receivers; and

an internal controller configured to record signals from each of the acoustic receivers and configured to process the signals to determine a shear wave propagation slowness for a formation surrounding the acoustic logging tool.

2. The acoustic logging tool of claim 1, wherein the acoustic source is a quadrapole source.

3. The acoustic logging tool of claim 2, wherein the acoustic source includes four source elements that are equally spaced about the circumference of the logging tool, and wherein opposing elements are excited in-phase, and elements 90° apart are excited in inverse-phase.

4. The acoustic logging tool of claim 3, wherein each source element includes a piezoelectric transducer.

5. The acoustic logging tool of claim 1, wherein the array of acoustic receivers includes a set of four receiver elements at each of a plurality of positions along the longitudinal axis of the logging tool, wherein the receiver elements of each set are equally spaced about the circumference of the logging tool.

6. The acoustic logging tool of claim 5, wherein the acoustic source includes four source elements that are equally spaced about the circumference of the logging tool, and wherein each of the source elements is aligned with a respective one of the receiver elements in each set of receiver elements.

7. The acoustic logging tool of claim 5, wherein the internal controller inverts signals from two opposing receiver elements in each set of receiver elements and combines the inverted signals with signals from the remaining two receiver elements in the set of receiver elements to obtain a combined signal for each set of receiver elements.

8. The acoustic logging tool of claim 7, wherein each of the receiver elements includes a piezoelectric transducer.

9. The acoustic logging tool of claim 1, wherein the internal controller is configured to determine a phase semblance as a function of frequency and slowness from the receiver signals.

10. The acoustic logging tool of claim 9, wherein the internal controller is configured to identify a phase semblance peak associated with each of a plurality of frequencies, and wherein the internal controller is configured to identify a smallest slowness value associated with the phase semblance peak as the shear wave propagation slowness for the formation.

11. The acoustic logging tool of claim 1, wherein the tool is configured for logging while drilling.

12. The acoustic logging tool of claim 1, wherein the source excites waves having frequencies greater than 2 kHz.

13. A method of determining the shear wave propagation slowness of a formation, the method comprising:

exciting waves that propagate along a borehole in quadrapole mode;

receiving acoustic signals at each of a plurality of positions along the borehole; and

calculating, from the acoustic signals, slowness values associated with a peak phase semblance as a function of frequency.

14. The method of claim 13, wherein the peak phase semblance is associated with a borehole interface wave.

15. The method of claim 13, further comprising:

determining a minimum slowness value associated with the peak phase semblance.

16. The method of claim 15, further comprising:

providing the minimum slowness value as an estimate of the shear wave propagation slowness.

17. The method of claim 13, further comprising:

processing the acoustic signals to enhance the quadrapole response of a receiver array before said act of calculating slowness values.